

What is claimed is:

1. A method for forming a multi-transmittance photomask on a transparent substrate comprising the steps of:

5       forming a first light blocking layer on the substrate;

          forming a phase-shifting layer on the first light blocking layer;

          forming a second light blocking layer on the phase-shifting layer;

10       removing a portion of the second light blocking layer to define a first pattern area, the remaining portion of the second light blocking layer defining a second pattern area; wherein

          the first pattern area transmits a first percentage of an  
15       exposing light, the second pattern area transmits a second percentage of the exposing light, the first percentage being greater than the second percentage.

2. A method for forming a multi-transmittance photomask  
20       on a transparent substrate according to claim 1, wherein the first and second light blocking layers are chromium layers,

          the first blocking layer having a first transmittance  $T_1$  for the frequency of exposure light, and

          the second blocking layer having a second transmittance  
25        $T_2$  for the frequency of exposure light.

3. A method for forming a multi-transmittance photomask on a transparent substrate according to claim 2, wherein the first transmittance T1 and the second transmittance T2 are unequal.

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4. A method for forming a multi-transmittance photomask on a transparent substrate according to claim 1, wherein the phase-shifting layer is an oxide layer.

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5. A method for forming a multi-transmittance photomask on a transparent substrate comprising the steps of:

forming a first light blocking layer on the substrate;

forming a phase-shifting layer on the first light blocking layer;

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forming a second light blocking layer on the phase-shifting layer;

forming a third light blocking layer on the second light blocking layer;

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removing a portion of the third light blocking layer to define a first pattern area and expose a portion of the second light blocking layer;

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removing a portion of the exposed portion of the second light blocking layer to define a second pattern area, the remaining portion of the third light blocking layer defining a third pattern area; wherein

the first pattern area has a first transmittance P1 of an exposing light, the second pattern area has a second

transmittance of P2 of the exposing light, and the third pattern area has a third transmittance P3 of the exposing light, having a relationship wherein  $P2 > P1 > P3$ .

5           6. A method for forming a multi-transmittance photomask on a transparent substrate according to claim 5, wherein the first, second and third light blocking layers are chromium layers,

          the first light blocking layer having a first  
10 transmittance T1 for the exposing light,

          the second light blocking layer having a second transmittance T2 for the exposing light, and

          the third light blocking layer having a third transmittance T3 for the exposing light.

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          7. A method for forming a multi-transmittance photomask on a transparent substrate according to claim 5, further comprising the step of forming an etch barrier layer on the second light blocking layer before forming the third light  
20 blocking layer.

          8. A method for forming a multi-transmittance photomask on a transparent substrate according to claim 5, wherein the phase-shifting layer is an oxide layer and produces a phase-  
25 shift  $\Pi$  in the exposing light.

9. A method for forming a multi-transmittance photomask on a transparent substrate according to claim 8, wherein the etch barrier layer is substantially transparent to the exposing light.

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10. A method for forming a multi-transmittance photomask on a transparent substrate according to claim 6, wherein  $T1 \neq T2$ ,  $T2 \neq T3$ , and  $T1 \neq T3$ .

10 11. A method for forming a multi-transmittance photomask on a transparent substrate according to claim 6, wherein  
the first pattern area transmittance  $P1$  is  $T1 * T2 + \Pi$ ;  
the second pattern area transmittance  $P2$  is  $T1 + \Pi$ ; and  
the third pattern area transmittance  $P3$  is  $T1 * T2 * T3 + \Pi$ .

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12. A method for forming a multi-transmittance photomask on a transparent substrate according to claim 11, wherein  $T1 * T2 * T3 + \Pi < 1\%$ .

20 13. A multi-transmittance photomask on a transparent substrate having a first, second, and third pattern regions;  
the first pattern region comprising a stacked structure of a first light blocking layer and a phase-shifting layer;  
the second pattern region comprising a stacked structure  
25 of the first light blocking layer, the phase-shifting layer,  
and a second light blocking layer;

the third pattern region comprising a stacked structure of the first light blocking layer, the phase-shifting layer, the second light blocking layer, and a third light blocking layer.

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14. A multi-transmittance photomask on a transparent substrate having a first, second, and third pattern regions according to claim 13, wherein

the first, second and third light blocking layers are  
10 chromium layers.

15. A multi-transmittance photomask on a transparent substrate having a first, second, and third pattern regions according to claim 14, wherein

15 the phase-shifting layer comprises an oxide.

16. A multi-transmittance photomask on a transparent substrate having a first, second, and third pattern regions according to claim 13, wherein

20 the first pattern region transmits more of an exposing light than the second pattern region; and

the second pattern region transmits more of the exposing light than the third pattern region.

25 17. A multi-transmittance photomask on a transparent substrate having a first, second, and third pattern regions according to claim 16, wherein

the third pattern region has a transmittance of essentially 0% of the exposing light.

18. A method for forming a multi-transmittance photomask  
5 on a transparent substrate comprising the steps of:  
forming a first light blocking layer on the substrate;  
forming a phase-shifting layer on the first light  
blocking layer;  
forming a second light blocking layer on the phase-  
10 shifting layer;  
forming a third light blocking layer on the second light  
blocking layer;  
forming a first photoresist pattern on the third light  
blocking layer;  
15 etching the third light blocking layer, the second light  
blocking layer, the phase-shifting layer, and the first light  
blocking layer, using the first photoresist pattern as an etch  
mask, to form exposure openings;  
removing the first photoresist pattern;  
20 forming a second photoresist pattern to expose a portion  
of the third light blocking layer;  
etching the third light blocking layer, using the second  
photoresist pattern as an etch mask, to define a first pattern  
area and thereby expose a portion of the second light blocking  
25 layer;  
removing the second photoresist pattern;

forming a third photoresist pattern to expose a portion of the second light blocking layer in the first pattern area;

etching the exposed portion of the second light blocking layer in the first pattern area to define a second pattern area, the remaining portion of the third light blocking layer defining a third pattern area; and

removing the third photoresist pattern, wherein

the first pattern area has a first transmittance  $P1$  of an exposing light, the second pattern area has a second transmittance of  $P2$  of the exposing light, and the third pattern area has a third transmittance  $P3$  of the exposing light, having a relationship wherein  $P2 > P1 > P3$ .